

REMARKS

Claims 1-31, 64, 66, 67, and 69-96 are canceled. Claims 32, 55 and 97 are amended. Claims 32-63, 65, 68, 97 and 98 are pending in the present application.

Claim 55 stands objected to because of informalities involving placement of a comma. Claim 55 is amended in accordance with the suggestion on page 2 of the Office Action. In light of the amendment, Applicants submit that claim 55 is in condition for allowance and respectfully requests that the objection be withdrawn.

Claim 98 stands rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,338,996 ("Iizuka"). Applicants respectfully traverse this rejection.

Claim 98 recites a method of forming a capacitor in a semiconductor device comprising, *inter alia*, "forming a dielectric layer over the bottom electrode" and "annealing the dielectric layer with a first oxidizing gas anneal for about 10 seconds to about 60 minutes, at a temperature from about 300 to about 800°C, and at a pressure of less than 760 Torr." Claim 98 also recites "forming a top electrode over said annealed dielectric layer; and annealing said top electrode with a second oxidizing gas anneal for about 10 seconds to about 60 minutes, at a temperature from about 300 to about 800°C, and at a pressure of less than 760 Torr."

Iizuka does not disclose all the limitations of claim 98. In particular, Iizuka does not disclose "annealing the dielectric layer with a first oxidizing gas anneal . . . at a pressure of less than 760 Torr" or "annealing said top electrode with a second oxidizing gas anneal . . . at a pressure of less than 760 Torr," as recited in claim 98. On the contrary, Iizuka discloses an "anneal in a nitrogen atmosphere of 1 atmospheric pressure," or 760 Torr. However, Iizuka does not disclose annealing the dielectric layer with an oxidizing gas anneal at less than 760 Torr. Since Iizuka does not disclose

all the limitations of claim 98, claim 98 is patentable over the reference. Accordingly, Applicants respectfully request that the 35 U.S.C. § 102(e) rejection of claim 98 be withdrawn, and the claim allowed.

Claims 32-36, 40-45, 47-49, 51, 52, 54, 57, 58, 62, 63 and 97 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka. Applicants respectfully traverse this rejection.

Claim 32, as amended, recites a method of forming a capacitor comprising, *inter alia*, "forming a bottom conducting layer, . . . forming a dielectric layer over the bottom conducting layer, . . . forming a top electrode with a top conducting layer over the annealed dielectric layer; and annealing the top electrode with a second anneal process using an oxidizing gas anneal, said oxidizing gas anneal performed between 10 seconds to about 30 minutes at a pressure less than 760 Torr."

Similarly, claim 97, as amended, recites a method of forming a capacitor comprising, *inter alia*, "forming a bottom electrode; forming a dielectric layer over the bottom electrode; forming a top electrode over said dielectric layer; and annealing said top electrode with an oxidizing gas anneal at a temperature greater than 400°C and a pressure of less than 760 Torr." Iizuka does not teach or suggest annealing the top electrode at a pressure of less than 760 Torr.

As discussed above with respect to claim 98, Iizuka does not disclose annealing the dielectric layer with oxidizing gas anneal at fewer than 760 Torr. Therefore, Iizuka does not teach or suggest performing an oxidizing gas anneal on the top electrode "between 10 seconds to about 30 minutes at a pressure less than 760 Torr," as recited in claim 32 or "annealing said top electrode with an oxidizing gas anneal at a temperature greater than 400°C and a pressure of less than 760 Torr," as

recited in claim 97. Since Iizuka does not teach or suggest all the limitations of claims 32 and 97, claim 32, claims 33-36, 40-45, 47-49, 51, 52, 54, 57, 58, 62 and 63 depending therefrom and claim 97 are patentable over the reference. Accordingly, Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 32-36, 40-45, 47-49, 51, 52, 54, 57, 58, 62, 63 and 97 be withdrawn, and the claim allowed.

Claims 37, 38 and 50 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka, in view of U.S. Patent No. 5,452,178 ("Emesh"). Applicants respectfully traverse this rejection.

Claims 37, 38 and 50 depend from claim 32. Iizuka and Emesh, whether considered alone or in combination, do not teach or suggest all the limitations of claim 32. As discussed with respect to claim 32 above, Iizuka fails to teach or suggest annealing the top electrode at "a pressure of less than 760 Torr." Emesh does not supplement the deficiency of Iizuka in this respect. Emesh is entirely silent on annealing the top electrode, much less annealing it at a pressure of less than 760 Torr. Since Iizuka and Emesh fail to teach or suggest all the limitations of claim 32, claims 37, 38 and 50 depending therefrom are patentable over the references. Accordingly, Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 37, 38 and 50 be withdrawn, and the claim allowed.

Claims 39, 46 and 53 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka, in view of U.S. Patent No. 6,303,426 ("Alers"). Applicants respectfully traverse this rejection.

Claims 39, 46 and 53 depend from claim 32. Iizuka and Alers, whether considered alone or in combination, do not teach or suggest all the limitations of claim 32. As discussed above, Iizuka does not teach or suggest "annealing the top electrode

with a second anneal process using an oxidizing gas anneal . . . at a pressure of less than 760 Torr,” as recited in claim 32. Alers does not supplement the deficiency of Iizuka in this respect. Alers discloses that “providing a plasma of a gas that includes nitrogen . . . at a pressure in the range of approximately 0.1 Torr to 10 Torr” to treat the bottom electrode and that the “capacitor dielectric 70 is then annealed using a plasma generated gas of oxygen and/or nitrogen by thermal treatment.” However, Alers, like Iizuka, is silent on “annealing the top electrode with a second anneal process using an oxidizing gas anneal . . . at a pressure of less than 760 Torr.”

Since Iizuka and Alers fail to teach or suggest all the limitations of claim 32, claims 39, 46 and 53 depending therefrom are patentable over the references. Accordingly, Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 39, 46 and 53 be withdrawn, and the claim allowed.

Claim 55 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka, in view of Alers, and further in view of Emesh. Applicants respectfully traverse this rejection.

Claim 55 depends from claim 32. Iizuka, Alers and Emesh, whether taken alone or in combination, do not teach or suggest all the limitations of claim 32. As discussed above, none of Iizuka, Alers and Emesh teach or suggest “annealing the top electrode with a second anneal process using an oxidizing gas anneal . . . at a pressure of less than 760 Torr,” as recited in claim 32. Since none of the references teach or suggest all the limitations of claim 32, claim 55 depending therefrom is patentable over the reference. Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claim 55 be withdrawn, and the claim allowed.

Claims 59, 60 and 64-68 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka in view of U.S. Patent No. 6,475,854 ("Narwankar"). Applicants respectfully traverse this rejection.

Claims 59, 60 and 64-68 depend from claim 32. Iizuka and Narwankar, whether considered alone or in combination do not teach or suggest all the limitations of claim 32. First, there is no motivation in the references, nor would one with ordinary skill in the art be motivated, to combine Iizuka and Narwankar to obtain the claimed invention. Narwankar discloses that "the annealing environment may comprise an inert gas, or a gas mixture comprising an inert gas and oxygen, or even 100% oxygen." Col 10, lines 3-5. By contrast, Iizuka discloses that an "anneal in a 100% oxygen atmosphere . . . causes peel off regardless of the pressure and there arises a problem of non-conductivity," and that "after the upper electrode is formed, anneal is performed in a mixture atmosphere of oxygen concentration of 0 to 5% and nitrogen." Col. 5, lines 18-25. Therefore, Iizuka *teaches away* from the methods of Narwankar. Since Iizuka teaches away from the methods of Narwankar, one with ordinary skill in the art would not be motivated to combine their teachings to obtain the invention of claim 32.

Even assuming, *arguendo*, that motivation exists to combine the references (which it does not), the references do not teach or suggest all the limitations of claim 32. As discussed above, Iizuka does not teach or suggest "forming a top electrode with a top conducting layer over the annealed dielectric layer; and annealing the top electrode with a second anneal process using an oxidizing gas anneal . . . at a pressure of less than 760 Torr," as recited in claim 32.

Narwankar does not supplement the disclosure of Iizuka in this respect. Narwankar discloses that the "lower oxygen-containing metal layer 604 and the lower metal layer 602 together form the lower electrode 605." Col. 10, lines 12-13; Fig 6b.

Narwankar also discloses that “[s]ubsequent to the formation of the lower oxygen-containing layer 604, an insulating layer 606 is formed, . . . preferably a material having a high dielectric constant.” Col 10, lines 18-21; Fig. 6c. Narwankar further discloses that “an upper electrode is formed on the insulator layer 606,” the formation of which “involves depositing a first upper metal layer 608, treating the first upper metal layer 608 to form an upper oxygen-containing layer 610 and then depositing a second upper metal layer 612.” Col. 10, lines 52-58; Figs. 6d-f. The process by which the upper metal layer 608 of Narwankar is treated to form the upper oxygen-containing layer 610 is an anneal in an oxygen-containing environment. Col. 11, lines 4-5. According to Narwankar, the top electrode is formed by forming a first upper metal layer 608 on the insulating layer 606, “annealing of the first upper metal layer 608 . . . by exposing the first upper metal layer 608 to an oxygen-containing gas while heating the substrate,” before a “second upper metal layer 612 is then deposited onto the upper oxygen-containing layer 610.” Col. 11, lines 8-18. Therefore, Narwankar discloses an annealing process in the formation of the top electrode, but does not teach or suggest “forming a top electrode with a top conducting layer over the annealed dielectric layer” and further “annealing the top electrode with a second anneal process using an oxidizing gas anneal,” as recited in claim 32. Narwankar is entirely silent on “annealing the top electrode with a second anneal process,” much less performing the anneal “at a pressure of less than 760 Torr,” as recited in claim 32.

Since Iizuka and Narwankar do not teach or suggest all the limitations of claim 32, claim 32 and claims 59, 60 and 64-68 depending there from are patentable over the references. Accordingly, Applicants respectfully request that the 35 U.S.C. § 103(a) rejection of claims 59, 60 and 64-68 be withdrawn, and the claim allowed.

Claim 61 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Iizuka, in view of U.S. Patent No. 6,387,802 (“Marsh”). Applicants respectfully traverse

this rejection.

Applicants respectfully submit that Marsh is not a proper reference under 35 U.S.C. § 103(a) pursuant to 35 U.S.C. § 103(c). Section 103(c) states that subject matter developed by another person, which qualifies as prior art only under §§ 102 (e), (f) and (g) does not preclude patentability under § 103 where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

STATEMENT OF COMMON OWNERSHIP

At the time the present invention was made, the invention and the subject matter of Marsh were owned by or subject to an obligation of assignment to Micron Technology, Inc. The assignment of Marsh to Micron Technology, Inc. is shown in the face of the patent; and the assignment of the present invention to Micron Technology, Inc., recorded in the United States Patent and Trademark Office (USPTO) at Patent Reel 01847, Frame 0723, evidence this common ownership.

Therefore, Marsh is not a proper reference under 35 U.S.C. § 103(a), and Applicant respectfully requests withdrawal of this rejection, and the allowance of claim 61.

In view of the above amendment, Applicants believes the pending application is in condition for allowance.

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Respectfully submitted,

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